DOCUMENT RESUME

ED 298 353 CE 050 964

TITLE	Agricultural Machinery Service. A Curriculum Guide for Agricultural Education.
INSTITUTION	Henrico County Public Schools, Glen Allen, VA. Virginia Vocational Curriculum Center.
SPONS AGENCY	Virginia State Dept. of Education, Richmond. Div. of Vocational and Adult Education.
PUB DATE	85
NOTE	90p.
AVAILABLE FROM	Virginia Vocational Curriculum and Resource Center, 2200 Mountain Road, Glen Allen, VA 23060-2208 ($5.10).
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	*Agricultural Education; *Agricultural Engineering; *Agricultural Machinery; Competence; *Competency Based Education; Course Content; Course Organization; Equipment; Job Skills; *Occupational Information; Secondary Education; State Curriculum Guides; Task Analysis; Vocational Education
IDENTIFIERS	Virginia

ABSTRACT

This curriculum guide provides descriptions and sequenced topical outlines for courses in agricultural mechanics, especially in Virginia. It provides teachers with a logical order for teaching the tasks that students should master to comply with competency-based education requirements. It is also intended to help administrators and supervisors in organizing agricultural education programs and to provide information on the program for guidance counselors. Following an introduction that provides an overview of the agricultural mechanics program by identifying its purposes and objectives, course options, and course requirements, the Guide Application section divides agricultural mechanics into courses. This section also contains a list of representative "Dictionary of Occupational Titles" (DOT) job titles that apply to this domain and are the basis for the tasks/competencies identified in this guide. The final section contains the program title and description, the courses included in the program, the applicable DOT job titles, and a description and topical outline for each course. Appendix A provides suggested tools and equipment lists for the courses under the agricultural mechanics domain. Appendix B contains reference materials suggested for the agricultural machinery service courses. (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED298353

AGRICULTURAL MACHINERY SERVICE

A CURRICULUM GUIDE FOR AGRICULTURAL EDUCATION

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Commonwealth of Virginia
Department of Education
Vocational and Adult Education
Richmond, Va. 23216

1985

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

F Armstrong

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

CE050964

AGRICULTURAL MACHINERY SERVICE

A
Curriculum Guide
for
Agricultural Education

Prepared by

Virginia Vocational Curriculum Center
Henrico County Public Schools
Department of Vocational
and Community Education
Glen Allen, Virginia 23060

In Cooperation With

Agricultural Education Service
Vocational and Adult Education
Virginia Department of Education
Richmond, Virginia 23216

Commonwealth of Virginia
Department of Education
Vocational and Adult Education
Richmond, Virginia 23216

1985

ACKNOWLEDGEMENTS

The contents of this curriculum guide were extracted from the Agricultural Machinery Service Instructional Resource Guide, developed for the Virginia Department of Education, Divisions of Vocational and Adult Education under the provisions of a CBE Project Contract (VA-80-C-132-AD-001B) awarded to Dinwiddie County Public Schools.

Recognition is extended to Hattie Walker, Project Director, and to Carnell Evans, teacher at Dinwiddie County Senior High School, and David Lewis and W. Bradbury Pebbles, teachers at Rowanty Vocational Technical Center. They are responsible for the planning, organizing, coordinating, and writing of the resource guide.

Dr. Kay B. Brown, Vocational Curriculum Development Supervisor, Virginia Department of Education, is recognized for coordinating the final publication process. Appreciation is expressed to Glenn A. Anderson, Supervisor for Agricultural Education, Virginia Department of Education, who served as technical coordinator and provided invaluable assistance and advice.

The organization, editorial revisions, and design format necessary to prepare this curriculum guide for publication were performed by the Virginia Vocational Curriculum Center, administered by the Henrico County Public Schools, Department of Vocational and Community Education.

Flora C. Armstrong, Center Director
Peggy Lum Watson, Writer/Editor

Dewey T. Oakley, Jr., Director
Division of Vocational Program Services
Virginia Department of Education

W. Tommy Johnson, Associate Director
Agricultural Education
Virginia Department of Education

CONTENTS

	Page
PURPOSE AND ORGANIZATION	1
INTRODUCTION	3
GUIDE APPLICATION	7
SECONDARY PROGRAM AND COURSES:	
Agricultural Mechanics	9
Agricultural Machinery Service III . . .	11
Agricultural Machinery Service IV . . .	27
Agricultural Machinery Service V . . .	45
APPENDICES:	
Appendix A: List of Suggested Equipment	69
Appendix B: References	79

PURPOSE AND ORGANIZATION

PURPOSE

The purpose of this curriculum guide is to provide descriptions and sequenced topical outlines pertaining to courses in the occupational domain of agricultural mechanics. It provides teachers with a logical order for teaching the tasks that students should master to comply with competency-based education requirements.

This publication also is intended to assist administrators and supervisors in organizing and conducting agricultural education programs which meet the needs of high school students who seek vocational training in agricultural mechanics.

It is designed to assist guidance counselors by providing summarized information which they can use when exploring with students possible programs and careers in agriculture.

ORGANIZATION

The Introduction provides an overview of the agricultural mechanics program course by identifying its purposes and objectives, course options, and requirements of the course. Following the Introduction is the Guide Application which divides the occupational domain of agricultural mechanics into courses. This section also contains a list of representative Dictionary of Occupational Titles job titles which apply to this domain and are the basis for the tasks/competencies identified in this guide. (A more complete listing may be found in the Dictionary of Occupational Titles, 4th ed., U.S. Department of Labor, 1977.)

The section, Secondary Programs and Courses, contains the program title and description, the courses included in the program, the applicable DOT job titles, and a description and topical outline for each course.

Appendix A provides suggested tools and equipment lists for the courses under the agricultural mechanics domain. Appendix B contains reference materials suggested for the agricultural machinery service courses. Both are designed to facilitate the implementation of a competency-based agricultural mechanics program.

INTRODUCTION

I. Definition

Agricultural Machinery Service III, IV, and V are secondary vocational courses which involve the operation, maintenance, set-up, adjustment, repair, and the reconditioning and overhaul of agricultural machinery and equipment. These courses include dealership organization, management, sales, human relations, and leadership development topics. The study of career opportunities and the development of job experience through supervised occupational experiences are also a part of this program.

II. Purposes

The primary purposes of the Agricultural Machinery Service course of study are the following:

A. To provide for students job entry and marketable skill training in agricultural machinery and related occupations;
B. To provide for students a broad base of occupational experiences and information upon which they can make a career decision;
C. To contribute to the fulfillment of the broad educational objectives set forth in the high schools where these courses are taught.

III. Objectives

The objectives of the Agricultural Machinery Service courses are the following:

A. To enable students to experience and develop a knowledge of career opportunities;
B. To provide job experience through planning and conducting occupational experience programs;
C. To promote an understanding of the organization and management of agricultural machinery dealerships;

D. To develop leadership potential and human relation skills
E. To develop machinery service skills with sufficient competency for gainful employment
F. To develop safe work habits and attitudes
G. To contribute to the fulfillment of the general educational objectives of the high school where this course is taught
H. To relate specialized knowledge and develop technical skills in machinery operation, maintenance, repair, and overhaul
I. To provide a foundation for post-high school education in agriculture.

IV. Enrollment Guidelines for Students

The three-year program in agricultural mechanics is designed for students in the tenth, eleventh, and twelfth grades. Agricultural Science and Mechanics I and II are considered to be prerequisites for enrollment in the machinery service courses.

V. Occupational Experience Program

Each student is required to carry out a well planned and supervised occupational experience program as an integral part of the program expectations. Experiences may be provided in the school mechanics laboratory, on farms, in nearby farm equipment business, or by a combination of these sources. Students are advised to complete one year of study prior to placement in work experience programs. Students may expect to be placed in an agricultural machinery business on a co-operative work experience program during the final year of the course. The time necessary for conducting and coordinating occupational experience programs is considered to be in addition to in-school instructional time.

VI. Hours of Instruction

Agricultural Mechanics is a program comprised of 1080 hours of instruction. Each of the three courses in the program is designed as a one-year, double-period course. In situations where these hours cannot be met, the teacher, with proper administrative guidance and approval, may select units of instruction from this guide which best fit community and student needs.

VII. Advisory Groups

An advisory council consisting of local machinery dealers, farmers, school administrators, parents, and other interested persons should be formed tc assist in establishing and conducting this program. The advisory council should make recommendations relative to course establishment, curriculum content, facility and equipment needs, occupational experience programs, placement, and youth organization activities.

GUIDE APPLICATION

This curriculum guide is based on the following Dictionary of Occupational Titles (DOT) job titles contained in the occupational domain of Agricultural Mechanics.

DOT Job Title	DOT Code
Agricultural Equipment Parts Salesperson	279.357-062
Tractor Mechanic	620.281-058
Farm Equipment Mechanic I	624.281-010
Farm Equipment Mechanic II	624.381-014
Diesel Mechanic	625.281-010
Small Engine Mechanic	625.281-034

Therefore, the guide is useful in developing and selecting instructional material and implementing competency-based education for the following program and courses:

Program	Courses
AGRICULTURAL MECHANICS (CIP 01.0204)	AGRICULTURAL MACHINERY SERVICE III (8016)
	AGRICULTURAL MACHINERY SERVICE IV (8018)
	AGRICULTURAL MACHINERY SERVICE V (8020)

Additional information concerning the application and use of this guide in program planning and development should be addressed to:

Agricultural Education Service
P.O. Box 6Q
Department of Education
Richmond, Virginia 23216

SECONDARY PROGRAMS AND COURSES

PROGRAM TITLE: Agricultural Mechanics

DESCRIPTION: Agricultural Machinery Service is a secondary vocational program which involves the operation, maintenance, set-up, adjustment, repair, reconditioning, and overhaul of agricultural machinery and equipment. The program includes dealership organization, management, sales, human relations, and leadership development topics. The study of career opportunities and the development of job experience through supervised occupational experiences are also a part of this program.

CIP CODE: 01.0204

SUGGESTED GRADE LEVELS: 10 - 12

APPROVED COURSE	VA COURSE CODE
Agricultural Machinery Service III	8016
Agricultural Machinery Service IV	8018
Agricultural Machinery Service V	8020

PROGRAM OPTIONS: Option I: 8016, 8018, 8020
Option II: 8016, 8018

DOT CODE	DOT TITLE
279.357-062	Agricultural Equipment Parts Salesperson
620.281-058	Tractor Mechanic
624.281-010	Farm Equipment Mechanic I
624.381-014	Farm Equipment Mechanic II
625.281-010	Diesel Mechanic
625.281-034	Small Engine Mechanic

(Codes and Titles are applicable to all courses)

AGRICULTURAL MACHINERY SERVICE III (8016)

COURSE DESCRIPTION: Agricultural Machinery Service III is designed as a one-year, double-period, occupational preparation course offered at the tenth- or eleventh-grade level. Agricultural Machinery Service III prepares students for entry employment and advancement in the agricultural equipment industry, or for the operation and maintenance of farm equipment. Students learn to use wrenches, precision measuring tools, and testing equipment. The course also includes instruction in safety, human relations, small engines, and farm tractor maintenance, and an introduction to tractor engine analysis.

PREREQUISITE: Agricultural Science and Mechanics II

SUGGESTED GRADE LEVELS: 10 - 11

AGRICULTURAL MACHINERY SERVICE III (8016)

Content Outline

I. ORIENTING THE STUDENT TO AGRICULTURAL MACHINERY SERVICE

- A. Demonstration of good safety practices
  1. Personal safety equipment
  2. Proper use of tools, equipment, supplies
  3. Fire extinguishers
- B. Maintenance of inventory control system
  1. Ordering of merchandise
  2. Recording of inventory
  3. Receiving and stocking of inventory
- C. Maintenance of a clean and orderly work area
- D. Adherence to departmental policies

II. IDENTIFYING CAREER OPPORTUNITIES IN AGRICULTURAL MACHINERY SERVICE

- A. Occupations available
- B. Competencies and requirements needed

III. PARTICIPATING IN SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAM

- A. Local occupational situations
- B. Annual plan

III. B. 1. Individual plan development
2. Evaluation of community needs

C. Occupational experience work agreement

D. Occupational tasks

1. Identification of tasks
2. Keeping of records

IV. DEVELOPING LEADERSHIP SKILLS

A. Parliamentary procedures

1. Purpose
2. Sources of information
3. Shop duty assignment procedures

B. Youth organization (FFA)

1. Duties of officers
2. Participation

C. Oral delivery

1. Outline preparation
2. Oral presentation

D. Panel discussion

1. Benefits and participation
2. Leadership role

E. News release

1. Information covered
2. Writing techniques

F. Committee meetings

V. PERFORMING GENERAL SKILLS AS A TRACTOR MECHANIC

A. Operating principles of internal combustion engine

1. History
2. Cycles
3. Components
4. Construction and design

B. Measuring and testing of equipment

1. Identification of instruments
2. Use of instruments

C. Inspection of new tractor parts for shipping damage

1. Selection of tools
2. Check of packing list
3. Return of damaged parts

D. Tire check for pressure, wear, and defects

1. Safety aspects
2. Procedures to follow

E. Operation of tractor

1. Safety aspects
2. Guidelines
3. Startup and shutdown procedures
4. Laws pertaining to tractor operation

VI. OVERHAULING THE SMALL ENGINE

A. Cleaning of small engine

1. Safety aspects
2. Steps involved

VI. B. Replacement of worn or defective piston

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

C. Installation of piston rings

1. Safety aspects
2. Installation procedures

D. Replacement of cylinder sleeve

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

E. Ridge reaming of top of cylinder

1. Safety aspects
2. Ridge reaming procedures

F. Replacement of connecting rod

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

G. Replacement of camshaft

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

H. Replacement of crankshaft

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

VI. I. Replacement of oil seals

1. Safety aspects
2. Replacement procedures

J. Replacement of valves and valve seats

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

K. Grinding of valves and valve seats

1. Safety aspects
2. Troubleshooting steps
3. Grinding procedures

L. Lapping of valves

1. Lapping procedures
2. Compression leakage

M. Replacement of damaged thread

1. Safety aspects
2. Replacement steps

N. Repair of damaged thread

1. Safety aspects
2. Repair procedures

O. Deglazing of cylinder

1. Safety aspects
2. Deglazing procedures

P. Installation of short block

1. Safety aspects
2. Installation procedures

VII. MAINTAINING AND SERVICING MANUAL STARTER

A. Manual starter check for proper operation

1. Safety aspects
2. Troubleshooting steps
3. Checking procedures

B. Replacement of defective or worn starter spring

1. Safety aspects
2. Replacement procedures

C. Replacement of starter clutch

1. Troubleshooting steps
2. Replacement procedures

D. Replacement of starter rope

1. Safety aspects
2. Replacement procedures

VIII. MAINTAINING, SERVICING, AND REPAIRING IGNITION SYSTEM

A. Inspection, reinstallation, or replacement of flywheel

1. Safety aspects
2. Procedures to follow

B. Replacement of point plunger

C. Replacement of points and condenser

D. Adjustment of armature air-gap

E. Testing and replacement of coil

VIII. E. 1. Safety aspects
2. Procedures to follow

F. Testing and replacement of ignition wires

1. Safety aspects
2. Troubleshooting steps
3. Procedures to follow

G. Ignition system timing of lawn mower or chain saw engine

H. Replacement of safety switch

1. Safety aspects
2. Troubleshooting steps

IX. MAINTAINING AND SERVICING CHARGING CIRCUIT

A. Cutout relay adjustment

1. Safety aspects
2. Adjustment procedures

B. Checking of armature for short, using armature growler

1. Safety aspects
2. Checking procedures

C. Checking and replacement of field winding

1. Safety aspects
2. Ohmmeter use
3. Charging circuit structure

D. Cleaning of commutator

1. Safety aspects
2. Cleaning procedures

E. Checking and replacement of generator or starter brushes

IX. E. 1. Safety aspects
2. Procedures to follow

F. Replacement of alternator/generator bearings or bushings

1. Safety aspects
2. Replacement procedures

G. Troubleshooting of charging circuit

1. Safety aspects
2. Troubleshooting steps

H. Inspection and replacement of belt pulley and belt

1. Safety aspects
2. Procedures to follow

I. Replacement of alternator

1. Safety aspects
2. Replacement procedures

J. Replacement of rectifiers

1. Safety aspects
2. Replacement procedures

K. Replacement of voltage regulator

1. Safety aspects
2. Replacement procedures

L. Replacement of diode assembly

1. Safety aspects
2. Replacement procedures

X. MAINTAINING, SERVICING, AND REPAIRING FUEL SYSTEM

A. Removal and cleaning of fuel tank and lines

1. Safety aspects
2. Troubleshooting steps
3. Procedures to follow

B. Removal, cleaning, and reinstallation of fuel filter system

1. Safety aspects
2. Procedures to follow

C. Servicing of oil-bath air cleaner

D. Servicing of foam-type air cleaner

E. Servicing of dry-type air cleaner

F. Disassembling, cleaning, and reassembling of pulsation-type carburetor

1. Safety aspects
2. Troubleshooting steps
3. Procedures to follow

G. Disassembling, cleaning, and reassembling of vacuum-type carburetor

1. Safety aspects
2. Troubleshooting steps
3. Procedures to follow

H. Disassembling, cleaning, and reassembling of float-type carburetor

1. Safety aspects
2. Troubleshooting steps
3. Procedures to follow

X. I. Adjustment of carburetor float valve

1. Safety aspects
2. Adjustment procedures

J. Removal and reinstallation of carburetor diaphragm

1. Safety aspects
2. Procedures to follow

K. Disassembling, cleaning, and reassembling of fuel pump

1. Safety aspects
2. Troubleshooting steps
3. Procedures to follow

L. Fine tuning of carburetor

1. Safety aspects
2. Fine tuning procedures

M. Cleaning of crankcase breather

XI. MAINTAINING AND SERVICING LUBRICATION SYSTEM

A. Checking of engine crankcase oil level

1. Determination of changing time
2. Procedures for checking

B. Checking of transmission or differential lubricant level on plug-equipped tractor

1. Determination of checking time
2. Procedures for checking

C. Checking of transmission or differential lubricant level on tractor equipped with dip stick

D. Draining and refilling of differentials

XII. MAINTAINING AND SERVICING LAWN MOWER ASSEMBLY

A. Height of cut adjustment

1. Safety aspects
2. Adjustment procedures

B. Grinding and balancing of rotary blade

1. Safety aspects
2. Procedures to follow

C. Lubrication of mower

1. Safety aspects
2. Lubrication procedures

D. Replacement of drive cogs on self-propelled, walk-behind mower

1. Safety aspects
2. Troubleshooting steps
3. Procedures to follow

E. Steering assembly repair on riding lawn mower

1. Safety aspects
2. Troubleshooting steps
3. Repairing procedures

F. Replacement of belts

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

XII. G. Replacement of throttle cable

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

XIII. MAINTAINING AND SERVICING CHAIN SAW ASSEMBLY

A. Replacement and adjustment of chain

1. Safety aspects
2. Procedures to follow

B. Check and adjustment of oiler

1. Troubleshooting steps
2. Procedures to follow

C. Lubrication of roller nose bar

1. Safety aspects
2. Lubrication procedures

D. Servicing of defective or worn rails

1. Safety aspects
2. Troubleshooting steps
3. Servicing procedures

E. Replacement of worn sprocket

1. Safety aspects
2. Troubleshooting steps
3. Replacement procedures

F. Replacement of broken drive link

1. Safety aspects
2. Replacement procedures

XIII. G. Replacement of roller on cutter bar

1. Safety aspects
2. Replacement procedures

H. Sharpening of saw chain

1. Safety aspects
2. Sharpening procedures

I. Troubleshooting for cutter problems

1. Safety aspects
2. Troubleshooting steps

XIV. SERVICING TIRES

A. Demounting of large implement tire

B. Demounting of small implement tire with machine

C. Demounting of small implement tire without machine

D. Demounting of tire with split rim

E. Mounting of implement tire

F. Repair of tube puncture

G. Repair of tubeless tire puncture

H. Servicing of tires with fluid

XV. ASSEMBLING EQUIPMENT

A. Primary tillage equipment assembly

B. Secondary tillage equipment assembly

XV. C. Planting equipment assembly

D. Cultivation and weed control equipment assembly

E. Fertilizing equipment assembly

F. Corn harvesting equipment assembly

G. Forage harvesting equipment assembly

H. Grain harvesting equipment assembly

I. Hay harvesting equipment assembly

J. Crop processing equipment assembly

K. Front loader equipment assembly

AGRICULTURAL MACHINERY SERVICE IV (8018)

COURSE DESCRIPTION: Agricultural Machinery Service IV is designed as a one-year, double-period, occupational preparation course offered at the eleventh- or twelfth-grade level. The course includes instruction in the operation of a parts department. Also included is instruction pertaining to newly developed agricultural machines, engine analysis and troubleshooting, basic hydraulics, leadership training, mechanical power transfer systems, the implement industry, metal fusion and fabrication welding, and the adjustment and repair of tillage equipment.

PREREQUISITE: Agricultural Machinery Service III

SUGGESTED GRADE LEVELS: 11 - 12

AGRICULTURAL MACHINERY SERVICE IV (8018)

Content Outline

I. ORIENTING THE STUDENT TO AGRICULTURAL MACHINERY SERVICE

II. PARTICIPATING IN SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAM

- A. Identification of occupational tasks
  1. Program analysis
  2. Job task identification
  3. Record maintenance
- B. Identification of appropriate FFA awards
- C. Identification of fringe benefits

III. DEVELOPING LEADERSHIP SKILLS

- A. Development of personal leadership characteristics
  1. Student organization committees
  2. Parliamentary procedures
- B. Development of citizenship characteristics acceptable to society
  1. Values of FFA
  2. Participation in FFA

IV. PERFORMING SUPERVISORY, ADMINISTRATIVE, AND EVALUATIVE DUTIES AS AN AGRICULTURAL EQUIPMENT PARTS SALESPERSON

A. Arrangement of work schedule

B. Calculations of discounts

C. Calculation of dollar turnover rate

D. Examination of returned parts for defects

1. Determination of source of damage
2. Handling of warranty coverage

E. Maintenance of department safety standards and operating procedures

1. OSHA codes
2. Business safety committee

F. Receipt of parts shipment

1. Checking of parts
2. Unpacking of parts

G. Stocking of fast- and slow-moving parts when using card file inventory system

H. Stocking of fast- and slow-moving parts when using computer inventory system

V. PERFORMING CLERICAL DUTIES AS AN AGRICULTURAL EQUIPMENT PARTS SALESPERSON

A. Acceptance of time payments

1. Procedures to follow
2. Recording of payment

V. B. Addition of parts to card file inventory system

1. Completion of inventory cards
2. Sequencing of cards

C. Deletion of obsolete parts from card file inventory system

D. Addition of parts to computer inventory system

E. Deletion of parts from computer inventory system

F. Completion of parts identification tags

G. Ordering of parts when using card file inventory system

H. Ordering of parts when using computer inventory system

I. Request for up-to-date microfiche and parts catalogs from manufacturers

J. Sending of parts to customer

K. Stocking of self-service shelves

VI. PERFORMING CUSTOMER SALES DUTIES AS AN AGRICULTURAL EQUIPMENT PARTS SALESPERSON

A. Building of merchandise displays

1. Safety rules
2. Procedures to follow

B. Use of microfiche to determine part number

C. Use of parts catalog to determine part number

VI. D. Update of parts numbers and prices in the parts catalog

1. Identification of outdated parts
2. Destruction of outdated pages

E. Update of parts numbers and prices in microfiche file

F. Computation of sales tax

G. Displays of parts, based on seasonal trends

1. Use of dealer's handbook
2. Kinds of props
3. Procedures for arranging displays

H. Estimation of freight charges

1. Determination of weight
2. Determination of shipping cost
3. Determination of insurance cost

I. Explanation of parts warranty and guarantee provisions to customer

1. Provisions of warranties
2. Influence on coverage

J. Completion of sales slips

K. Filling of telephone orders for parts

L. Handling of customer-returned sale

1. Securing of information from customer
2. Inspection of returned parts

M. Maintenance of clean and orderly customer and parts area

1. Departmental regulations
2. Purpose

VI. N. Supplying of parts to service shop

1. Determination of parts needed
2. Use of parts catalog or microfiche file
3. Securing of parts from storage bin
4. Billing for parts
5. Delivery of parts

VII. PERFORMING ACCOUNTING DUTIES AS AN AGRICULTURAL EQUIPMENT PARTS SALESPERSON

A. Balance of charge receipts and cash tickets

1. Cash sales
2. Charge sales

B. Correction of sales errors when using card file inventory system

C. Correction of sales errors when using computer inventory system

D. Maintenance of lost-sales records when using card file inventory system

E. Maintenance of lost-sales records when using computer inventory system

F. Development of weekly sales reports from daily receipts when using computer inventory system

VIII. PERFORMING GENERAL SKILLS AS A TRACTOR MECHANIC

A. Operating principles of internal combustion engine

1. History
2. Cycles
3. Components and systems

VIII. B. Use of measuring and testing equipment

1. Kinds of instruments
2. Uses of instruments

C. Use of gas and arc welding unit

1. Safety aspects
2. Metals preparation

D. Inspection of new tractor parts for shipping damage

1. Safety aspects
2. Damaged parts return procedures

E. Preparation of steam cleaner for use

1. Safety aspects
2. Preparation steps

F. Steam cleaning of tractor

1. Safety aspects
2. Steps to follow

G. Preparation and shutting down of steam cleaner

1. Safety aspects
2. Steps to follow

H. Preparation of tractor for painting

1. Safety aspects
2. Preparation steps
   a. Dent removal
   b. Surface preparations

I. Painting of tractor

1. Safety aspects
2. Spray gun operation
3. Painting steps

VIII. I. 4. Cleanup

J. Repair of brake assembly

1. Safety aspects
2. Steps to jack up tractor
3. Manufacturer's procedures
4. Cleanup

K. Servicing of air cleaner (dry-element)

1. Safety aspects
2. Servicing procedures

L. Servicing of air cleaner (oil-bath)

1. Safety aspects
2. Servicing procedures

M. Servicing of drive shafts

1. Safety aspects
2. Drive shaft types
3. Servicing procedures

N. Servicing of hydraulic governor (diesel)

1. Troubleshooting steps
2. Servicing procedures

O. Servicing of torque converter

1. Reasons for service
2. Servicing procedures

P. Servicing of universal joint

1. Safety aspects
2. Troubleshooting steps
3. Servicing procedures

VIII. Q. Adjustment of wheel bearings

1. Safety aspects
2. Adjustment steps

R. Checking of tires for pressure, wear, and defects

1. Safety aspects
2. Checking procedures

S. Use of communications equipment

1. Applicable laws and regulations
2. Operation procedures

IX. MAINTAINING AND SERVICING STORAGE BATTERY

A. Activation of dry-charged battery

1. Safety aspects
2. Activation steps

B. Charging of wet-cell battery

1. Safety aspects
2. Charging procedures

C. Cleaning of battery terminals, cables, and box

1. Safety aspects
2. Cleaning procedures

D. Measurement of specific gravity, using hydrometer

1. Safety aspects
2. Steps in measuring

IX. E. Measurement of battery voltage, using voltmeter

1. Safety aspects
2. Measuring procedures

F. Running of load test on battery

1. Safety aspects
2. Steps to follow

G. Running of load test on battery, using starter motor

1. Safety aspects
2. Steps to follow

H. Tightening of battery cables and battery hold-down clamps

1. Safety aspects
2. Procedures to follow

X. MAINTAINING AND SERVICING IGNITION CIRCUIT

A. Measurement of resistance, using ohmmeter

1. Ohmmeter calibration
2. Resistance measuring steps

B. Replacement of ignition distributor points and condenser

1. Safety aspects
2. Replacement steps

C. Replacement of ignition distributor

D. Replacement of primary ignition wire

X. E. Servicing of spark plugs

1. Safety aspects
2. Servicing procedures

F. Setting of breaker point dwell, using dwell meter

G. Setting of ignition timing, using timing light

1. Purpose
2. Effect on engine performance
3. Proper timing

H. Testing of distributor advance mechanism

1. Timing light connection
2. Testing steps

I. Testing and replacement of ignition coil

1. Ignition coil function
2. Testing and replacement procedures

J. Testing of ignition distributor

XI. MAINTAINING AND SERVICING CHARGING CIRCUIT

A. Adjustment of voltage regulator, using fixed-resistance method

1. Pertinent specifications and procedures
2. Adjustment procedures

B. Adjustment of voltage regulator, using variable-resistance method

1. Generator cycling
2. Voltage regulator diagramming

XI. C. Checking of armature and fields of charging system

1. Open circuit testing
2. Shorted or grounded armature testing
3. Openfield circuit testing

D. Polarizing of tractor generator

1. Externally grounded generator
2. Internally grounded generator

E. Testing of tractor generator on bench

1. Connection of ammeter and switch in series
2. Connection of voltmeter from generator output to ground
3. Connection of carbon pile resistor across battery
4. Connection of jumper lead to generator field terminal

F. Testing of charging circuit, using voltmeter, ammeter, or carbon pile

1. Testing procedures
2. Test circuit setup

XII. MAINTAINING AND SERVICING STARTING CIRCUIT

A. Checking of armature and fields of starter

1. Ground test
2. Short test
3. Balance test

B. Checking of ignition switch

1. Continuity tester attachment
2. Switch activation

XII. B. 3. Wires to switch reconnection

C. Checking of safety switch

1. Continuity tester attachment
2. Switch activation
3. Wires to switch reconnection

D. Checking of solenoid

1. Checking procedures
2. Voltmeter use

E. Replacement of bearings and bushings

1. Replacement procedures
2. Bushing collapse prevention

F. Replacement of ring gear on flywheel

1. Replacement procedures
2. Necessary equipment

G. Replacement of starter brushes

H. Replacement of starter drive

I. Replacement of starter motor solenoid

J. Replacement of starter motor

K. Turning of armature on starter

XIII. MAINTAINING AND SERVICING GASOLINE FUEL SYSTEM

A. Adjustment of carburetor float

B. Adjustment of carburetor idle air/fuel mixture

1. Adjustment procedures
2. Effect on engine operation

XIII. C. Adjustment of engine idle speed

D. Cleaning of carburetor

1. Cleaning procedures
2. Safety aspects

E. Cleaning of settling bulb (sediment bowl)

F. Installation of carburetor repair kit

G. Replacement of fuel pump

H. Servicing of fuel pump (diaphragm type)

I. Servicing of fuel tank and lines

XIV. MAINTAINING AND SERVICING BASIC ENGINE

A. Adjustment of valve clearance

B. Checking of cylinder head for warpage

C. Cleaning of cylinder block, oil passages, and pistons

1. Safety equipment
2. Cleaning procedures

D. Deglazing of cylinder

1. Purpose
2. Deglazing procedures

E. Grinding of valves

1. Precautions
2. Mating of valves

XIV. F. Installation of crankshaft

1. Crankshaft parts
2. Items to check
3. Installation procedures

G. Installation of connecting rod caps

H. Installation of cylinder head

I. Installation of front oil seal

J. Replacement of rear main oil seal

K. Installation of timing chain or gears

L. Measurement of bearing clearance

M. Measurement of camshaft for wear

N. Measurement and recording of crankshaft main and rod journals

O. Measurement of cylinder taper

P. Measurement of piston-ring end gap

Q. Measurement of piston-ring land clearance

R. Measurement of valve-stem guide clearance

S. Refacing of valve seats

T. Removal of carbon from ring grooves

U. Removal of cylinder ridge

V. Removal of piston assembly

W. Replacement of camshaft bearings

X. Replacement of oil pan gasket assembly

XIV. Y. Replacement of piston rings

Z. Replacement of rocker arms

AA. Servicing of intake manifold

BB. Testing of valve springs

CC. Torque of main bearings

XV. MAINTAINING AND SERVICING CLUTCH

A. Adjustment of clutch free play

1. Free-play measurement
2. Free-play adjustment

B. Servicing of dry clutch

C. Servicing of expanding shoe clutch

1. Two types
   a. Centrifugal
   b. Mechanical
2. Procedure for servicing

D. Servicing of magnetic clutch

E. Servicing of wet clutch

F. Servicing of overrunning clutch

1. Types
   a. Roller
   b. Cam or sprag
   c. Spring
2. Servicing procedures

XVI. MAINTAINING AND SERVICING COOLING SYSTEM

A. Flushing and cleaning of radiator

B. Replacement of cooling system thermostat

1. Common thermostat types
2. Replacement procedure

C. Replacement of radiator hose

D. Replacement of water pump

E. Servicing of fanbelt

F. Testing of cooling system for leaks

G. Testing of radiator coolant

H. Testing of radiator pressure cap

I. Testing of thermostat

XVII. MAINTAINING AND SERVICING LUBRICATION SYSTEM

A. Changing of oil filter

B. Changing of tractor oils

C. Checking of engine crankcase oil level

D. Checking of transmission or differential lubricant level on plug-equipped tractor

E. Checking of transmission or differential lubricant level on tractor equipped with dip stick

F. Packing of wheel bearings

1. Cleaning procedures
2. Replacing and assembling steps

XVII. G. Servicing of oil cooler

H. Servicing of oil pump

XVIII. MAINTAINING AND SERVICING DIFFERENTIALS

A. Replacement of brake and axle seals

B. Replacement of brake and axle gaskets

XIX. SERVICING CONVEYANCE SYSTEM

A. Adjustment of chain

B. Adjustment of belt

C. Alignment of chain and sprocket

D. Cleaning and lubrication of chain

E. Cleaning of sprocket

F. Installation of chain idler

G. Replacement of belt sheave

H. Repair of chain

I. Replacement of belt

J. Replacement of sprocket

K. Replacement of elevator paddles

L. Replacement and adjustment of speed control linkage

AGRICULTURAL MACHINERY SERVICE V (8020)

COURSE DESCRIPTION: Agricultural Machinery Service V is a one-year, advanced, double-period, occupational preparation course offered at the twelfth-grade level. Much of the instruction may be offered through individualized instruction and independent study. Major learning areas include instruction in operation of an agricultural machinery service department; adjustment, maintenance, and repair of planting, spraying, fertilizing, and crop harvesting equipment; diesel engine systems; organization and management of agricultural machinery dealerships; and agricultural sales skills.

PREREQUISITE: Agricultural Machinery Service IV

SUGGESTED GRADE LEVEL: 12

AGRICULTURAL MACHINERY SERVICE V (8020)

Content Outline

I. SELECTING AND EVALUATING EMPLOYMENT OPPORTUNITIES

- A. Evaluation of personal qualifications for employment
- B. Techniques for interviewing
- C. Identification of personal opportunities for employment

II. PARTICIPATING IN SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAM

- A. Summary and analysis of occupational experience records
- B. Completion of FFA proficiency award application
- C. Securing of a cooperative work experience
  1. Preparation of application letter
  2. Completion of application form
  3. Preparation for the interview

III. DEVELOPING LEADERSHIP SKILLS

- A. Acquisition of leadership experience
  1. Preparation and delivery of a speech
  2. Leadership in meetings

III. A. 3. Participation in a radio or TV program

B. Cooperation with others

C. Development of citizenship skills

IV. MAINTAINING AND SERVICING HYDRAULICS

A. Changing of hydraulic filters

1. Location of filter
2. Procedures to follow

B. Cleaning and flushing of hydraulic system

1. Draining of system
2. Cleaning of filter elements
3. Flushing of old oil

C. Draining and refilling of hydraulic system

1. Draining of system
2. Replacement and tightening of drain plug
3. Cleaning of filler cap area

D. Use of hydraulic tester

1. Steam cleaning of machine
2. Operation of hydraulic tester

E. Repair of hydraulic-assist transmission

1. Steps in troubleshooting
2. Procedures to follow

F. Repair of hydraulic cylinders

1. Types of cylinders
2. Causes of and cures for hydraulic cylinder problems

IV. G. Replacement of hydraulic fitting

H. Service and adjustment of hydraulic-assist transmission

1. Steps in troubleshooting
2. Procedures to follow

I. Service and repair of hydraulic gear pump

1. Identification of gear pump
2. Check of gear teeth for wear
3. Measurement of gear shafts and gear
4. Procedures to follow

J. Service and repair of hydraulic motor

1. Basic types of hydraulic motors
2. Steps in troubleshooting
3. Procedures to follow

K. Service and repair of hydrostatic drive

1. Maintenance of working area
2. Procedures to follow

L. Service and repair of hydraulic pump

1. Types of pumps
   a. Gear
   b. Vane
   c. Piston
2. Steps in troubleshooting

M. Service and repair of hydraulic valves

N. Service and repair of internal hydraulic pump

1. Cleaning and inspection of pump
2. Replacement of worn or damaged parts
3. Reassembly of pump
4. Operation and adjustment of pump

IV. O. Troubleshooting of hydraulic-assist transmission

P. Servicing and repair of hydraulic radial piston pump

V. SERVICING CONVEYANCE SYSTEM

A. Replacement of charge pressure control valve, hydrostatic drive

B. Replacement of charge pump, hydrostatic drive

C. Replacement of directional control valve, hydrostatic drive

D. Replacement of high pressure relief valve, hydrostatic drive

VI. MAINTAINING AND SERVICING POWERTRAIN

A. Measurement of backlash and clearance in gear train

1. Disassembly of gear train
2. Reassembly of gear train

B. Measurement and adjustment of end-play movement in gear shaft

1. Mounting of dial indicator
2. Procedures to follow

C. Preloading of bearings in gear train

1. Adjustments in gear train
2. Reassembly of gear set

D. Service of constant-mesh transmission

VI. E. Service of power-shift transmission

1. Removal of transmission
2. Cleaning of parts
3. Prevention of serious problems
4. Reassembly of parts

F. Service of sliding-gear transmission

1. Removal of transmission
2. Cleaning of parts
3. Prevention of damage
4. Reassembly of parts

VII. MAINTAINING AND SERVICING DIFFERENTIALS

A. Adjustment of ring gear and pinion

1. Removal of parts
2. Check of ring gear backlash
3. Check of readings
4. Reassembly of parts

B. Preloading of bearings on axle shaft

1. Use of dial indicator
2. Determination of correct bearing preload
3. Reassembly of parts

C. Repair of differentials

1. Function of differentials
2. Common failures of differentials
3. Procedures to follow

D. Service of differential locks

1. Function of locks
2. Types of locks
3. Procedures for repair

VIII. MAINTAINING AND SERVICING FINAL DRIVE

A. Adjustment of chain drive in final drive

B. Adjustment of end play in final drive

1. Removal of parts
2. Check of end play
3. Procedures for adjustment

C. Preloading and installation of bearings in final drive

1. Common types of wheel bearing assemblies
   a. Spindle-type
   b. Axle-type
2. Procedures to follow

D. Service of final drive

1. Major types of final drive systems
   a. Pinion
   b. Planetary
   c. Chain
2. Types of gear reduction
3. Diagnosis of failures

E. Service of inboard and outboard mounted planetary drives

1. Durability of planetary systems
2. Function of final drive shaft
3. Basic parts of planetary drive system

IX. PERFORMING GENERAL SKILLS AS A TRACTOR MECHANIC

A. Operating principles of internal combustion engine

1. History and development of engine
2. Cycles of engine

IX. A. 3. Efficiency of engine
4. Construction and design of engine

B. Service of engine governor

1. Test of engine governor
2. Disassembly of parts
3. Reassembly of parts

C. Service of power take-off drive

1. Guidelines for safety
2. Steps in troubleshooting

D. Service of special drives

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures for servicing

E. Test of engine compression

1. Guidelines for safety
2. Steps in troubleshooting

F. Use of dynamometer

1. Guidelines for safety
2. Procedures for use

G. Check of torque converter with test equipment

1. Guidelines for safety
2. Procedures for checking

H. Storage of internal combustion engine

1. Long-term storage of engine
2. Short-term storage of engine

I. Operation of tractor

1. Guidelines for safety
2. Guidelines for operation

IX. I. 3. Location of controls
4. Laws on tractor operation

J. Use of communications equipment

1. Laws and regulations on use
2. Procedures for use

X. MAINTAINING AND SERVICING CLUTCH

A. Service of dry clutch

B. Service of expanding shoe clutch

1. Types of expanding shoe clutches
   a. Centrifugal
   b. Mechanical
2. Removal of parts
3. Cleaning of parts

C. Service of magnetic clutch

1. Disassembly of parts
2. Reassembly of parts

D. Service of overrunning clutch

1. Types of overrunning clutches
   a. Roller
   b. Cam or sprag
   c. Spring
2. Disassembly of parts
3. Reassembly of parts

XI. MAINTAINING AND SERVICING BASIC ENGINE

A. Adjustment of valve clearance

1. Clearance for hot and cold valves
2. Procedures for adjustment

XI. B. Checking of cylinder head for warpage

1. Removal and cleaning of head
2. Use of feeler gauge
3. Procedures for checking

C. Cleaning of cylinder block, oil passages, and pistons

1. Equipment for safety
2. Washing of parts
3. Blowing out of oil passages

D. Grinding of valves

1. Precautions for valve grinding
2. Grinding of valves to specified face angle

E. Installation of crankshaft

1. Identification of main parts
2. Things to check
3. Procedures for installation

F. Installation of connecting rod caps

1. Use of micrometer
2. Installation of new inserts

G. Installation of cylinder head

1. Use of gasket sealing compound
2. Coating of top of head gasket
3. Installation of head bolts

H. Measurement of bearing clearance

1. Disassembly of parts
2. Reassembly of parts

I. Measurement of camshaft for wear

1. Disassembly of parts
2. Reassembly of parts

XI. J. Measurement and recording of crankshaft main and rod journals

1. Cleaning and inspection of parts
2. Procedures to follow

K. Refacing of valve seats

1. Precautions for grinding
2. Tool-mating of valve
3. Procedures to follow

L. Replacement of camshaft bearings

1. Disassembly of parts
2. Lining up of oil holes
3. Reassembly of parts

M. Replacement of dry sleeves

N. Replacement of valve guides

O. Replacement of wet sleeves

XII. MAINTAINING AND SERVICING DIESEL FUEL SYSTEM

A. Bleeding of diesel fuel system

1. Loosening of bleed plugs
2. Activation of manual fuel pump lever

B. Service of diesel fuel filter

1. Disassembly of parts
2. Reassembly of parts

C. Service of diesel fuel injector

1. Function of injection nozzle
2. Procedures for servicing

XII. D. Service of diesel-injection pump

1. Rotation of engine
2. Starting of engine
3. Taking readings of the engine RPM

E. Service of diesel-transfer pump

1. Purpose of diesel-transfer pump
2. Types of diesel-transfer pumps
3. Procedures for servicing

F. Service of turbocharger

1. Function of turbocharger
2. Steps in servicing

G. Timing of fuel injector pump on engine

1. Alignment of parts
2. Bleeding of system

XIII. MAINTAINING AND SERVICING CHARGING CIRCUIT

A. Replacement of amperage gauge

1. Securing of replacement gauge
2. Removal of amperage gauge from mounting
3. Identification of wire sources
4. Removal of wires
5. Mounting of replacement amperage gauge

B. Replacement of bearings

1. Identification of defective bearings
2. Procedures for replacement

C. Replacement of diodes

1. Location of defective diodes
2. Unsoldering of diode leads

XIII. C. 3. Pressing of old diodes out of plate
4. Pressing of new diodes into position
5. Soldering of leads

D. Replacement of generator brushes

1. Disconnection of brush wire lead
2. Removal of old brushes
3. Cleaning of commutator
4. Reconnection of brush wire lead
5. Polarization of generator

E. Replacement of heat sink

1. Disassembly of parts
2. Reassembly of parts

F. Service of alternator regulator

G. Test of alternator diodes

1. Connection of diode leads
2. Reversal of ohmmeter leads

H. Turning of armature

1. Fastening of armature
2. Turning of armature
3. Checking for roundness

XIV. SERVICING MECHANICAL COMPONENTS OF BALER

A. Replacement of compression roll spring, round baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

B. Replacement of floor and floor channels, round baler

XIV. B. 1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

C. Replacement of rollers on round baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

D. Adjustment of knife arm on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

E. Adjustment of knives on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

F. Adjustment of needles on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

G. Adjustment of slip clutches on twine baler (drive line and pickup drive)

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

H. Adjustment of tucker (twine) fingers on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

XIV. I. Adjustment of twine disc on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

J. Adjustment of bale care tension on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

K. Replacement of bill hook on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

L. Replacement of hay dog springs

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

M. Replacement of pin in bill hook pinion on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

N. Replacement of twine finger rod on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

O. Replacement of twine knife on twine baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

XIV. P. Sharpening of twine knife cutting edge on twine baler

1. Guidelines for safety
2. Procedures to follow

Q. Timing of feeder

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

R. Timing of plunger

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

S. Replacement of belts on round baler

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

XV. SERVICING MECHANICAL COMPONENTS OF COMBINE AND HARVESTER

A. Stabilization of concave leveling mechanism

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

B. Replacement of concave

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

C. Replacement of cutterbar

1. Guidelines for safety
2. Steps in troubleshooting

XV. C. 3. Procedures to follow

D. Replacement of feeder conveyor

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

E. Replacement of gathering chains

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

F. Replacement of grain or corn head

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

G. Replacement of rotor on combine (cylinders)

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

H. Replacement of snapping plates (bars)

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

I. Replacement of straw walkers

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

J. Replacement of threshing cylinder

1. Guidelines for safety
2. Steps in troubleshooting

XV. J. 3. Procedures to follow

K. Replacement of threshing fans

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

L. Adjustment of cylinder to concave for corn harvester

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

M. Adjustment of cylinder cut-off bar

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

N. Adjustment of drag chains and links

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

O. Adjustment of elevator chain

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

P. Adjustment of floating shoes

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

Q. Adjustment of reel speed

1. Guidelines for safety
2. Steps in troubleshooting

XV. Q. 3. Procedures to follow

R. Adjustment of sieves

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

S. Adjustment of snapping rolls

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

T. Adjustment of stripper plates

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

U. Adjustment of table balance springs

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

V. Lubrication of feeder chain

1. Guidelines for safety
2. Procedures to follow

W. Adjustment of slip clutches

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

X. Replacement of snapping rolls

1. Guidelines for safety
2. Procedures to follow

XV. Y. Timing of gathering chain

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

Z. Replacement of cutterbar on mower-conditioner/ windrower

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

AA. Replacement of guard on mower-conditioner/ windrower

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

BB. Replacement of hay conditioner universal joints

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

CC. Replacement of knife sections on mower-conditioner/windrower

1. Guidelines for safety
2. Procedures to follow

DD. Replacement of ledger plates on mower

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

EE. Replacement of wear plates on mower

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

XVI. SERVICING MECHANICAL COMPONENTS OF PLANTER

A. Replacement of disc furrow cover on corn planter

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

B. Replacement of press wheel furrow cover on corn planter

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

C. Replacement of hitches on corn planter

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

D. Replacement of marker on corn planter

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

E. Replacement of furrow opener

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

F. Replacement of sprockets on plate-type planter

1. Guidelines for safety
2. Steps in troubleshooting
3. Procedures to follow

APPENDICES

Appendix A: List of Suggested Equipment

Appendix B: References

APPENDIX A

LIST OF SUGGESTED EQUIPMENT

Item	Quanity Needed
HAND TOOLS	
Pinch bar set	1
Pry bar set	1
Wrecking bar	1
Battery service kit	2
Distributor head brush	2
Distributor head socket	2
Standard hand wire brush	24
Valve guide brush set	1
Bushing driver sets, 3/8" to 1 3/8" and 1 5/16" to 1 3/4"	2
Bushing inserter set	1
Camshaft bearing tool	1
Chisel and punch set	5
C-clamps, 4", 6", and 8" (4 of each size)	12
Clutch aligning tool	1
Cylinder sleeve puller with ratchet, handle, and adapter plates	1
Guide studs	2
Hammers, ball peen 1 1/2 lbs., brass, plastic tip, blacksmith, curved claw, and riveting (2 of each)	12
Sledge hammer, 8 lbs.	1
Ignition aligning tool	2
Magnetic pick-up tool	5
Rubber mallet	2
Nut splitter	5
Oil seal installer set	1
Plastic ring compressor, 3 1/2" to 7" capacity	2
Ring groove cleaner, 5"	2
Ring spreader, 3/64" to 1/4" ring capacity	2
Brake spring pliers, standard and truck (1 of each)	2
Slip joint pliers, 5"	6
Diagonal cutting pliers, 6"	2
Hose clamp pliers	2
Ignition pliers	2
Lineman's pliers, 7"	2

Item	Quantity Needed
Needle nose pliers, 4 1/2"	5
Retaining ring pliers	2
Channel lock pliers	5
Spark plug terminal pliers	2
Vise grip pliers, 7"	5
Hydraulic hand press, 25 ton capacity	1
Gear pullers set	1
Bearing pullers set	1
Punches, tapered, pin, brass (1 set of each)	3
Screwdriver set	1
Off set ratchet screwdriver with slotted and phillips heads	2
Magnetic screwdriver set	1
Socket set, 3/4" drive with metric adapters	1
Socket set, 1/2" drive with metric adapters	6
Spark plug socket set	3
Socket set, 3/8" drive with metric adapters	6
Socket set, 1/4" drive	6
Screw extractor set	1
Tool chest, 2 drawers	5
Rolling cabinet, 3 drawers	5
Valve guide cleaner, 5/16" to 5/8"	5
Valve keeper inserter	5
Valve lapper, dual cup	5
Valve lapper, hand	5
Valve lapper suction cups	2
Valve spring compressor	5
Adjustable end wrenches, 4", 8", and 12" (5 of each)	15
Allen wrench set	5
Allen wrench set, metric	2
Box end wrenches, 3/8" to 1 5/8"	5
Chain wrench, 23"	1
Combination wrenches, 3/8" to 1 5/8"	5
Combination metric, 10mm to 32mm	2
Distributor lock nut wrench	1
Distributor lock nut wrench, 13mm	1
Ignition wrench set	5
Impact wrench with sockets, phillips, and slotted screwdriver tips, 1/2" drive	1

Item	Quantity Needed
Oil filter wrench	1
Open end wrenches, 1/4" to 1 5/8"	5
Pipe wrench set, 6" to 24"	1
Spanner, 3/4" to 2"	2
Striking wrench set, 1 1/14", 1 3/8", 1 1/2", 1 5/8",1 3/4", 1 7/8", and 2"	1
Tappet wrench set, 7/16" to 7/8"	1

HOLE SIZING AND METAL CUTTING EQUIPMENT

Bolt cutter, 36"	1
Cylinder hone, 2" to 7" complete with stones	1
Cylinder ridge reamer, 2" to 5" capacity	1
Drill bit sets, 1/16" to 1/2" by 32nds	1
Drill bit, 1/2" to 3/4" by 16ths	4
Drill bits, 13/16" to 1" by 16ths	3
Drill bits, 1 1/8", 1 1/4", 1 3/8", and 1 1/2"	4
Portable drill, 3/8", reversing, various speed	2
Portable drill, 1/2", reversing	1
Drill press, 17", variable speed, 1 hp., tilting table (complete with accessories)	1
Drill press vise, 1 3/4" x 4"	1
Drill chuck, 3 jaw, O to 1/2" capacity	1
File sets:	
Flat, 6", 8", 10", 12", and 16"	2
Round, 6", 8", 10", 12", and 16"	1
Points, 5 1/4" x 5/16" x .044"	1
Triangular, 8"	1
Square, 8"	1
File handles, 4 9/16", 4 7/8", and 4 3/6" (10 of each)	30
File card	10
Grinder bench, 7" stones (complete w/accessories)	1
Grinder pedestal, 12" stones (complete w/accessories)	1
Grinder, portable disc	1
Grinding wheel dresser	1
Hacksaw, hand (with blades)	12
Hollow punch set	1
Pipe cutter, 1/8" x 2"	1
Pipe reamer	1

Item	Quantity Needed
Pipe threader, 1/2" to 2"	1
Reamer set	1
Shears, metal cutting	1
Snips, tinners (curved and straight)	2
Tap and die sets (1 or each)	3
English	
Metric	
Spark plug thread chaser	
Tubing cutter, 1/8" to 1 1/8"	1
Tubing flairing tool set	1
Valve shop	1

TESTING AND MEASURING DEVICES

Battery tester	1
Calipers, inside, outside, (English measure) (1 or each)	2
Calipers, vernier, English measure, 6" capacity	4
Calipers, vernier, metric, 150 mm capacity	1
Calipers, vernier, inside, outside, 6"/150mm capacity	1
Calipers, inside set, 4", 6", and 8"	1
Calipers, outside set, 4", and 6"	1
Center gauge, 60	2
Compression gauge	2
Current indicator	2
Crack detector, magnetic	1
Cylinder bone gauge	1
Depth gauge, micrometers, type	2
Dial indicator, .001 graduations (with base and magnetic holder)	1
Injector nozzle tester	1
Dividers set, 4", 6", and 8"	1
Drill gauge	1
Dynamometer	1
Engine analysis test equipment set	1
Feeler gauges	10
Growler, generator starter armature tester	1

Item	Quantity Needed
Hydraulic system tester (complete with accessories)	1
Hydrometers, battery	2
Hydrometers, antifreeze	2
Level, 24", aluminum	1
Magneto ignition analyzer	1
Micrometers:	
Outside English, 9-1"	12
Outside English, 1-2", 2-3", 3-4", and 4-5"	1
Outside metric, 0-25mm	1
Outside metric, 25-50mm	1
Outside metric, 50-75mm	1
Inside English, 2-8"	1
Oscilloscope engine analyzer	1
Radiator pressure tester	1
Radius gauge	1
Rules:	
Metal edge, 24"	15
Push-pull, pocket, 12'	15
Meter stick, 100cm	6
Screw pitch gauge	4
Spark plug gauge	12
Spring tester	1
Squares:	
Combination	12
Framing, 24"	4
Try, 6" blade	4
T-bevel, 6" blade	4
Steel tape:	
100'	1
50'	1
Straight edge, 18"	1
Tachometer	1
RPM speed indicator, hand held	1
Tap and drill gauge	1
Telescoping gauge, 5/16" to 6"	1
D.C. circuit tester	1
A.C. circuit tester	1
Combustion analyzer	1

Item	Quantity Needed
Vaccum fuel pump tester	1
Timing light	6
Tire pressure gauge:	
Tire pencil gauge, 1 to 50 lbs.	2
Air liquid, 10 to 50 lbs.	2
Truck tire, 60 to 160 lbs.	1
Tire thread depth gauge	2
Torque wrench:	
3/8" drive, 150 in-lbs., 175 kg-cm.	1
1/2" drive, 250 ft-lbs., 35 kg-m.	1
LIFTING, BLOCKING, AND HOLDING DEVICES	
A-frame hoist, 2 ton capacity	1
Jack stands, adjustable	16
Chain hoist, 2 ton capacity	1
Chain, towing, 3/8" x 14'	2
Engine repair stand	4
Hydraulic jacks, 1 1/2 and 5 ton capacity (2 of each)	4
Load adjuster sling	1
Load binder	2
Mobile floor crane, 4 ton capacity	1
Portable floor crane, 1 ton capacity	1
S-hooks, lifting	1
Vice, machinist, 4" jaws, 6" opening	6
Vice, pipe, 1/8" to 2" capacity	1
SMALL ENGINE TOOLS	
Crankshaft wrench	4
Cylinder bore gauge, 1 3/4" to 3 1/4"	4
Cylinder hone, 1 7/8", 2/34"	1
Small engines:	
4 cycle, vertical shaft	1
4 cycle, vertical crankshaft	1
4 cycle, horizontal crankshaft	10
2 cycle	1
Small engine test stand, adjustable positioner	12
Small engine tool set, B & S No. 291661 or equivalent	2

Item	Quantity Needed
Small engine tool, ZIM set or equivalent	4
Valve refacing lathe for small engines, hand operated	1
Valve seat cutter for small engines, hand operated	1
CLEANING EQUIPMENT	
Parts washer	1
High pressure washer	1
Shop vacuum cleaner, wet or dry	1
AUXILLARY SHOP EQUIPMENT	
Air compressor, 5 hp., 2 stage	1
Air compressor accessories:	
Hose, 5/16" x 25'	4
Quick couplers, male & female	10
Hose coupling nipples	4
Air blow gun	2
Sand blast gun	1
Air chuck	2
Dual foot chuck	1
Pipe nipple	4
Anvil, 140 pound	1
Anvil stand	1
Battery charger	1
Booster cables, No. 3 gauge, 20'	1
Battery carrier strap	2
Battery filler	2
Extension cord, 25'	8
Extension cord, 50'	1
Extension cord, reel 29'	1
Hydro-flater	1
Chassis lubrication unit, air operated	1
Gear lubrication unit, hydraulic operated	1
Portable drain tank	1
Drain pans	6
Grease gun, lever type	2
Grease fitting driver	2
Oiler, 1/2 pt. capacity	2
Pressure oiler, 5 oz. capacity	6

Item	Quantity Needed
Hydraulic pump oiler, 1 pt. capacity, 9" spout	1
Oil measures, 1 quart capacity	2
Suction gun, 20 oz. capacity	2
Paint spray respirator	5
Viscosimeter	5
Paint spray outfit	1
Spray gun, suction feed	
Detachable stern for gun	
Suction feed cup	
Air hose with detachable coupling	
Oil and water extractor	
Angle adapter	
Duster gun and adapter	
Soldering iron, electric, 3/8" tip, 100 watt and 7/8" tip, 300 watt (2 of each)	4
Soldering gun, electric	1
Propane torch kits	10
Trouble light, 25'	10
Arc welders, 295 amp. capacity	4
Welding helmet	4
Chipping hammers	4
Welding gloves, gauntlet	12
Welding apron	4
Welding clamps, vise grip type	6
Carbon arc torch	4
Welding cable extension	1
Oxyacetylene welding outfit (complete)	1

MISCELLANEOUS EQUIPMENT

Awls, scratch	4
Benches, 24", wall type	as needed
Paint brushes, 1", 2", and 4" (4 of each)	12
Carbon brushes	6
Wire brushes	12
Bucket, 12 quart capacity	2
Storage cabinets	as needed
Tool storage cabinets, birch plywood, 4' x 4'	as needed

Item	Quantity Needed
Tool pegboard, with hangers and hooks	as needed
Safety cabinets for paint and flammables	2
Oily waste can	5
Radiator refiller can	1
Safety can, 2 1/2 gallon capacity and 5 gallon capacity (2 of each)	4
Chain link detacher	1
Clip board	15
Creeper	2
Desk, teachers	1
Engraving tool, electric	1
Funnels:	
Tractor lock-on	1
1 pint capacity	1
1 quart capacity	1
Canned oil dispenser	1
Staple gun	1
Curved claw hammers	2
Tire tool hammer	2
Hose, rubber, 3/4" x 50'	2
Ignition simulator	1
Stepladder, 6 foot	1
Leather punch	1
Dust respirator	2
Pop rivet gun kit	1
Safety glasses monitor--complete 36 pairs of gloves	1
Safety face shield	10
Saws:	
Hand crosscut	2
Hand rip	2
Sabre saw kit	1
Portable circular saw	1
Floor scraper	2
Shelving	as needed
Shovels, square point and round point (1 of each)	2
Sickle bar tool	1
Floor squeegee	2
Letter stamping set	1
Number stamping set	1

Item	Quantity Needed
Mechanic's work stool	4
Tire tools:	
Removal tool	2
Rim tool	2
Valve tool	2
Portable metal work table	4

APPENDIX B

REFERENCES

AAVIM. 1972. Electric Motors, Selection, Protection, and Drives. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. 1974. Hydraulics: Care and Operation, Vol. I. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. 1974. Hydraulics: Inspecting and Testing. American Association for Vocational Instructional Materials. Athens, Georgia

AAVIM. 1974. Hydraulic Systems for Tractors and Other Mobil Equipment: Inspecting and Testing, Vol. II. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. Selecting and Maintaining Field Mowers. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. 1979. Shop Safety Skills. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. 1975. Small Engines: Care, Operation, Maintenance, and Repair, Vol. I and II. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. 1971. The Tractor Electrical System. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. Tractor Hydraulics. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. 1975. Tractor Maintenance. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. Tractor Transmissions. American Association for Vocational Instructional Materials. Athens, Georgia.

AAVIM. 1969. Understanding and Measuring Horsepower. American Association for Vocational Instructional Materials. Athens, Georgia.

Alabama State Department of Education. Agribusiness Metal Working. Agricultural Education Service. Montgomery, Alabama.

Ball, Tom. 1970. Source Unit in Oxyacetylene Welding. Department of Vocational Education, Colorado State University. Denver, Colorado.

Barger, E. L. 1963. Tractors and Their Power Units. John Wiley and Sons. New York, New York.

Bender, R. E. and R. E. Taylor. 1974. The FFA and You. Interstate. Danville, Illinois.

B. F. Goodrich Company. What You Should Know About Farm Tires. Akron, Ohio.

Binkley, Harold and Carsie Hammonds. 1970. Experience Programs for Learning Vocations in Agriculture. Interstate. Danville, Illinois.

Briggs and Stratton Corporation. Maintenance and Repair. Briggs and Stratton Corporation. Milwaukee, Wisconsin.

Briggs and Stratton Corporation. Repair Instructions IV. Briggs and Stratton Corporation. Milwaukee, Wisconsin.

Briggs and Stratton Corporation. Small Engines. Briggs and Stratton Corporation. Milwaukee, Wisconsin.

Brown, A. D. 1973. Tractor and Small Engine Maintenance, 4th edition. Interstate. Danville, Illinois.

Cameron, W. A. The Gasoline Engine Electrical System. Agricultural Engineering Department, Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

Clemson University. 1969. Agricultural Shop Safety: Teacher's Guide. Department of Agricultural Education, Clemson University. Clemson, South Carolina.

Clevite Service. Mechanic's Engine Bearing Reference Manual. Cleveland, Ohio.

Crunkilton, J. R. and S. T. Grant. 1978. Student Injury and Teacher Liability. Division of Vocational and Technical Education, Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

DANA Parts Company. Service Manual for Doctor of Motors. Technical Service Department. Hagerstown, Indiana.

DeVilbiss Company, The. The ABC's of Spray Equipment. The DeVilbiss Company. Toledo, Ohio.

DeVilbiss Company, The. 1954. The ABC's of Spray Painting, 3rd edition. Toledo, Ohio.

Federal Communication Commission. 1966. Rules and Regulations of the FCC, Vol. IV. U.S. Government Printing Office. Washington, D.C.

Foutes, William A. 1977. Diesel Engine Mechanics. Mid-America Vocational Consortium, Inc.

Fregly, Bert. 1974. How to Get a Job. ETC Publication. Homewood, Illinois.

Future Farmers of America. Chapter Guide to FFA Activities. National FFA Supply Service. Alexandria, Virginia.

Future Farmers of America. FFA Activity Handbook. National FFA Supply Service. Alexandria, Virginia.

Future Farmers of America. FFA Advisors Handbook. National FFA Supply Service. Alexandria, Virginia.

Future Farmers of America. 1978. Official Manual. National FFA Supply Service. Alexandria, Virginia.

General Motors Corporation. Better Ignition. Delco-Remy Division. Anderson, Indiana.

General Motors Corporation. Diesel--The Modern Power. Educational Relations Section. Warren, Michigan.

General Motors Corporation. The Ignition Circuit and How It Works. Delco-Remy Division. Anderson, Indiana.

General Motors Corporation. Separately Mounted Coils. Delco-Remy Division. Anderson, Indiana.

Giachino, J. W. 1977. Welding Skills and Practices. American Technical Society. Chicago, Illinois.

Griffin, Ivan and Edward Roden. 1970. Welding Processes. Delmar Publishers (Canada LTD).

Harp, T. R. Improving Communications, Leadership, and Personal Development. Ohio Agricultural Education Curriculum Materials Service, The Ohio State University. Columbus, Ohio.

Harp, T. R. and L. H. Newcomb. Good Grooming, Leadership, and Personal Development. Ohio Agricultural Education Curriculum Materials Service, The Ohio State University. Columbus, Ohio.

Hemp, P. E. and A. H. Krebs. 1964. A Guide for Placement-Employment Programs in Agricultural Business and Industry. Interstate. Danville, Illinois.

Henderson, G. E. 1970. Tractor Operation and Daily Care. AAVIM. Athens, Georgia.

Henderson, G. E. and J. H. Turner. 1970. Tractor Maintenance Principles and Procedures. Athens, Georgia.

Hillison, John, ed. 1978. Virginia FFA Activity Handbook. Agricultural Education Program, Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

Hoerner, T. A. and F. W. Bear. 1975. Small Gasoline Engines: Operation and Maintenance. HOBAR Publications. St. Paul, Minnesota.

Hoerner, T. A. 1973. Power Tool Safety and Operation. HOBAR Publications, Inc. St. Paul, Minnesota.

Hoover, N. K. 1969. Handbook of Agricultural Occupations. Interstate. Danville, Illinois.

Hunt, Donnell. 1973. Farm Power and Machinery Management. Iowa State University Press. Ames, Iowa.

Implement and Tractor Shop Service Manuals. HOBAR Publications. St. Paul, Minnesota.

Implement and Tractor Publications, Inc. Implement and Tractor Flat Rate Manuals. Kansas City, Missouri.

International Harvester Company. I.H. Farm Equipment Safety: Instructor's Kit. Education Department. Chicago, Illinois.

International Harvester Company. There's a Future Here, Will You be In it? Education Department. Chicago, Illinois.

Intertec Publishing Corporation. 1975. Small Engines Service Manual. Kansas City, Missouri.

James F. Lincoln Company, The. 1964. Teacher's Manual: Arc Welding Instructions for the Beginners. The James F. Lincoln Arc Welding Foundation. Cleveland, Ohio.

Jefferson, T. B. and G. Woods. Metals and How to Weld Them. The James F. Lincoln Arc Welding Foundations. Cleveland, Ohio.

John Deere Company. 1974. Fundamentals of Machine Operation: Agricultural Machinery Safety. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Machine Operation: Combine Harvesting. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Machine Operation: Hay and Forage Harvesting. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Machine Operation: Planting. John Deere Service Publications. Moline, Illinois.

John Deere Company. 1973. Fundamentals of Machine Operation: Preventive Maintenance. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Machine Operation: Tractors. John Deere Service Publications. Moline, Illinois.

John Deere Company. 1971. Fundamentals of Service: Bearings and Seals. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Service: Belts and Chains. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Service: Combines and Balers. John Deere Service Publications. Moline, Illinois.

John Deere Company. 1972. Fundamentals of Service: Electrical Systems. John Deere Service Publications. Moline, Illinois.

John Deere Company. 1972. Fundamentals of Service: Engines. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Service: Fuels, Lubricants, and Coolants. John Deere Service Publications. Moline, Illinois.

John Deere Company. 1972. Fundamentals of Service: Hydraulics. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Service: Mowers. John Deere Service Publications. Moline, Illinois.

John Deere Company. Fundamentals of Service: Mowing and Spraying. John Deere Service Publications. Moline, Illinois.

John Deere Company. 1972. Fundamentals of Service: Power Trains. John Deere Service Publications. Moline, Illinois.

John Deere Company. 1971. Fundamentals of Service: Shop Tools. John Deere Service Publications. Moline, Il

John Deere Company. Fundamentals of Service: Tires and Tracks. John Deere Service Publications. Moline, Illinois

John Deere Company. The Operation, Care, and Repair of Farm Machinery. John Deere Service Publications. Moline, Illinois.

Jones, Fred R. 1963. Farm Gas Engines and Tractors. McGraw Hill Book Company. New York, New York.

Judge, A. W. 1958. Automobile Engine Overhaul. Pitman and Sons. London.

Kates, Edgar and William Luck. 1974. Diesel and High Compression Gas Engines, 3rd edition. American Technical Society. Chicago, Illinois.

Keily, H. J. and R. G. Walters. 1960. How to Find and Apply for a Job, 2nd edition. Southwestern Publishing Company. Cincinnati, Ohio.

Linde. The Oxyacetylene Handbook. Linde Division, Union Carbide Corporation. New York, New York.

McMillion, Martin B. 1979. Virginia Supervised Occupational Experience Record Book. Department of Education. Richmond, Virginia.

Martin Senour Paint Company. 1973. A Guide to Better Automotive Refinishing.

Massey-Ferguson Company. Parts Purchasing Control Procedure. Chicago, Illinois.

Moody, S. B. and L. E. Miller. 1974. FFA Leadership Handbook. Agricultural Education Program, Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

National Farm and Power Equipment Dealers Association. Farm and Power Equipment Retailer's Handbook. St. Louis, Missouri.

National Safety Council. Accident Facts. Chicago, Illinois.

National Safety Council. Farm and Ranch Safety Guide. Chicago, Illinois.

Ohio State University. 1971. Advertising and Promotion. Ohio Agricultural Education Curriculum Materials Service. Columbus, Ohio.

Ohio State University. 1965. Agricultural Salesmanship: Course Outline for Agricultural Machinery Service Occupations. The Center for Vocational and Technical Education. Columbus, Ohio.

Ohio State University. 1979. Business Practices for Agricultural Machinery Dealers. Ohio Agricultural Education Curriculum Materials Center.

Ohio State University. 1965. Human Relations in Agricultural Occupations. The Center for Vocational and Technical Education. Columbus, Ohio.

Ohio State University. 1970. Individual Study Guide on Electrical Systems for Spark Ignition Engines. Ohio Agricultural Education Curriculum Materials Service. Columbus, Ohio.

Ohio State University. 1965. Mechanical Power Training Systems--Module 8. Ohio Agricultural Curriculum Materials Service. Columbus, Ohio.

Ohio State University. 1971. Selling and Salesmanship. Ohio Agricultural Education Curriculum Materials Service. Columbus, Ohio.

P. A. Sturtevant Company. Torque Engine Specifications. Addison, Illinois.

Perfect Circle Corporation. 1961. For Better Gasoline Engine Overhaul. Hagerstown, Indiana.

Phipps, Lloyd J. 1977. Mechanics in Agriculture. Interstate. Danville, Illinois.

Resource Unit on Human Relations. 1971. Department of Agricultural Education, University of Arizona. Tucson, Arizona.

Ritchen, Ralph. Motors Truck Repair Manual. Motor Publishing Company. Cleveland, Ohio.

Robert, H. M. 1976. Robert's Rules of Order. Pyramid Publications. New York, New York.

Roy, Ewell P. Exploring Agribusiness, 2nd edition. Interstate. Danville, Illinois.

Shinn, Glen C. and C. R. Weston. 1978. Working in Agricultural Mechanics. McGraw Hill Book Company. New York, New York.

Silletto, T. A. and D. O. Hull. Safe Operation of Agricultural Equipment: Instructor's Manual. HOBAR Publications. St. Paul, Minnesota.

Silletto, T. A. and D. O. Hull. Safe Operation of Agricultural Equipment: Student Manual. HOBAR Publications. St. Paul, Minnesota.

Sperry Rand Corporation. 1967. Mobile Hydraulic Manual. Vickers Mobile Hydraulic Division. Troy, Michigan.

Stone, A. A. 1970. Careers in Agribusiness and Industry, 2nd edition. Interstate. Danville, Illinois.

Stone, A. A. and H. E. Culvin. 1967. Machines for Power Farming. John Wiley and Sons, Inc. New York, New York.

Tilman, Charles J. D. 1977. Agricultural Education Program. Division of Vocational and Technical Education, Virginia Polytechnic and State University. Blacksburg, Virginia.

Texas A and M University. 1967. Agricultural Mechanics--Equipment. Department of Agricultural Education. College Station, Texas.

Tobodit, William K. 1972. Diesel Fundamentals, Service, Repair. Goodheart-Wilcox Company. South Holland, Illinois.

Tobodlt, William K. and J. Purvis. Automotive Encyclopedia. Goodheart-Wilcox Company. South Holland, Illinois.

Turner, J. H. and G. E. Henderson. 1971. Farm Tractor Tune-Up and Service Specifications. AAVIM. Athens, Georgia.

University of Illinois. 1958. Farm Tractor Tune-Up. Vocational Agricultural Service. Urbana, Illinois.

University of Illinois. 1963. Spray Painting. Vocational Agriculture Service. Urbana, Illinois.

University of Illinois. 1967. The Ignition System--Testing and Analyzing Test Results. Vocational Agriculture Service. Urbana, Illinois.

U.S. Department of Health, Education, and Welfare. 1974. Agricultural Equipment and Mechanics Curriculum Guide. Ohio Career Education and Curriculum Management Laboratory in Agricultural Education, Ohio State University. Columbus, Ohio.

Vocational-Technical Education Consortium of States. 1977. A Catalog of Performance Objectives, Criterion-Referenced Measures, and Performance Guide for Small Engine Repair. V-TECS. Atlanta, Georgia.

Vocational-Technical Education Consortium of States. 1975. A Catalog of Performance Objectives, Criterion-Referenced Measures, and Performance Guides for Tractor Mechanic. V-TECS. Atlanta, Georgia.

Vocational-Technical Education Consortium of States. 1976. A Catalog of Performance Objectives, Criterion-Referenced Measures, and Performance Guides for Combination Welding. V-TECS. Atlanta, Georgia.

Wakeman, T. J. 1977. Modern Agricultural Mechanics. Interstate. Danville, Illinois.

As required by federal laws and regulations, the Virginia Department of Education does not discriminate on the basis of sex, color, race, religion, handicapping conditions, or national origin in employment or in its educational programs and activities.

The activity which is the subject of this report was supported in whole or in part by the U. S. Department of Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the U. S. Department of Education, and no official endorsement by the U. S. Department of Education should be inferred.

BEST COPY AVAILABLE